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Tools for Mapping Environmental Monitoring Data

(U.S.) Health Effects Research Lab., Research Triangle Park, NC

1990

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TOOLS FOR PRESENTING SPATIAL AND TEMPORAL PATTERNS OF ENVIRONMENTAL MONITORING DATA, Wilson B. Riggan, L. T. Heiderscheit, and John P. Creason, U. S. Environmental Protection Agency, Research Triangle Park, N. C. 27711

The EPA Health Effects Research Laboratory has developed this data presentation tool for use with a variety of types of data which may contain spatial and temporal patterns of interest. The technology links mainframe computing power to the new generation of "desktop publishing" hardware and software to produce publication-quality maps and tables. The major use of the techniques thus far has been in the publication of U. S. Cancer Mortality Rates and Trends 1950-1979: Volume IV. Maps of air pollution data have now been generated which show spatial and temporal patterns for emissions as well as ambient air quality levels, using a Macintosh II computer with a laser printer. These and other potential applications will be discussed.

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TOOLS FOR MAPPING ENVIRONMENTAL MONITORING DATA

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DISCLAIMER

This document has been reviewed in accordance with U.S. Environmental Protection Agency policy and approved for publication. Mention of trade names or cmmercial products does not constitute endorsement or recommendation for use.

Introduction

Many mapping programs are available for producing custom designed maps for a single document. These mapping programs are designed for the production of a single map, and although they require considerable time and effort, they are very satisfactory for a single document. Our mapping program is designed for production of a large number of maps. For example, our mapping program reads in the title, legends, coordinates, and data for each of the maps in U.S. Cancer Mortality Rates and Trends 1950-1979 Vol: IV, an example of which is shown in Figure 1. Our program also produced the CO Aerometric Map shown in Figure 2.

Hardware Requirements

This mapping system as it stands has special hardware needs. First, it requires a Postscript printer. Second, it requires a computer running under DOS or UNIX for down-loading the input data, running the mapping software, and driving the printer. Third, many monitoring data sets will require preprocessing of the data before going to the mapping program. For example, all mortality data requires the power of a mainframe computer.

Data Requirements

The Area Coordinates may be county boundaries from DIME files such as those used in the maps (Figures 1 and 2), or they may be coordinates of any area we wish to map. If boundaries are not available, boundaries may be scanned (digitized) from a sketch of the area. The set of coordinates must be complete for the area to be mapped. For example, while the aerometric data included only a small fraction of three thousand counties in the U.S., we included all county coordinates. The counties with missing data are colored white.

Environmental monitoring data may be mapped for any area for which coordinates are available. Any environmental monitoring data with non-random variation may be mapped.

Software Involved

The mapping program requires two distinct types of programs. The first is the preprocessing program, usually on a mainframe, which merges the coordinate file and the monitoring data file, and formats the output file for the mapping program.

Second the postscript mapping system (computer programs) reads the area coordinates and monitoring data and images the map, text, and legends on a desktop laser printer.

Products Generated by the System

This system can produce camera-ready copy for journals and other publications.

The major product generated by this system is U.S. Cancer Mortality Rates and Trends, 1950-1979, Volume IV: Maps, EPA/600/1-83015e, September 1987. The mapping program produced copy for the printer which was ready to be reproduced without further preparation.

Figure 2 shows another product from this mapping program. This map contains CO data for 1986 from the Aerometric Information Retrieval System, second maximum 8-hour averages by county, parts per million.

APPENDIX:

How to read Figure 1.

A. Type of cancer being mapped.

B. Race and sex of subject. Time period for death rate data.

C. This is the death rate bar. The arrow indicates the national average for the U.S. death rate. For the 1960-1969 period, the national average death rate is 46.8 deaths per hundred thousand population.

SHADED AREAS:

White	Between 1960 and 1969, for cancer of the trachea, bronchus and lung including pleura and other repiratory sites, the death rate for white males ranged between 14.42 and 47.80 per hundred thousand population.
LIGHT GRAY	. . . ranged between 47.80 and 54.39 deaths per 100,000 population.
MEDIUM GRAY	. . . ranged between 54.39 and 58.50 deaths per 100,000 population.
DARK GRAY	. . . ranged between 58.50 and 64.00 deaths per 100,000 population.
BLACK	. . . ranged between 64.00 and 90.16 deaths per 100,000 population.

D. This is the county cumulative percentile bar. To obtain a county percentile value, substract the difference between the beginning of a shaded area and the end of the same shade area. For example:

SHADED AREAS: For white males, during the 1960-1969 period. . .

WHITE	75% of all counties in the United States had between 14.42 and 47.80 cancer deaths per 100,000 population for cancer of the trachea, bronchus and lung including pleura and other respiratory sites.
LIGHT GRAY	15% of all counties in the United States had between 47.80 and 54.39 lung cancer deaths per 100,000 population.
MEDIUM GRAY	5% of all counties in the United States had between 54.39 and 58.50 lung cancer deaths per 100,000 population.
DARK GRAY	3% of all counties in the United States had between 58.50 and 64.00 lung cancer deaths per 100,000 population.
BLACK	2% of all counties in the United States had between 64.00 and 90.16 lung cancer deaths per 100,000 population.

The national average (indicated by the arrow) is 46.8 for 1960-1969. 15% percent of all counties in the United States (in the 60's) had between 14 and 48 deaths per 100,000 population for white males.

E. This is a graph for age specific death rates. The horizonal line indicates the age group. The vertical line indicates the number of deaths per hundred thousand.

For example: In the 70-74 year old category, 278.1 deaths per 100,000 population are attributed to cancer of the lung for white males.

F. This line indicates whether the data was derived from county boundaries or State Economic Area boundries.

Figure 1.

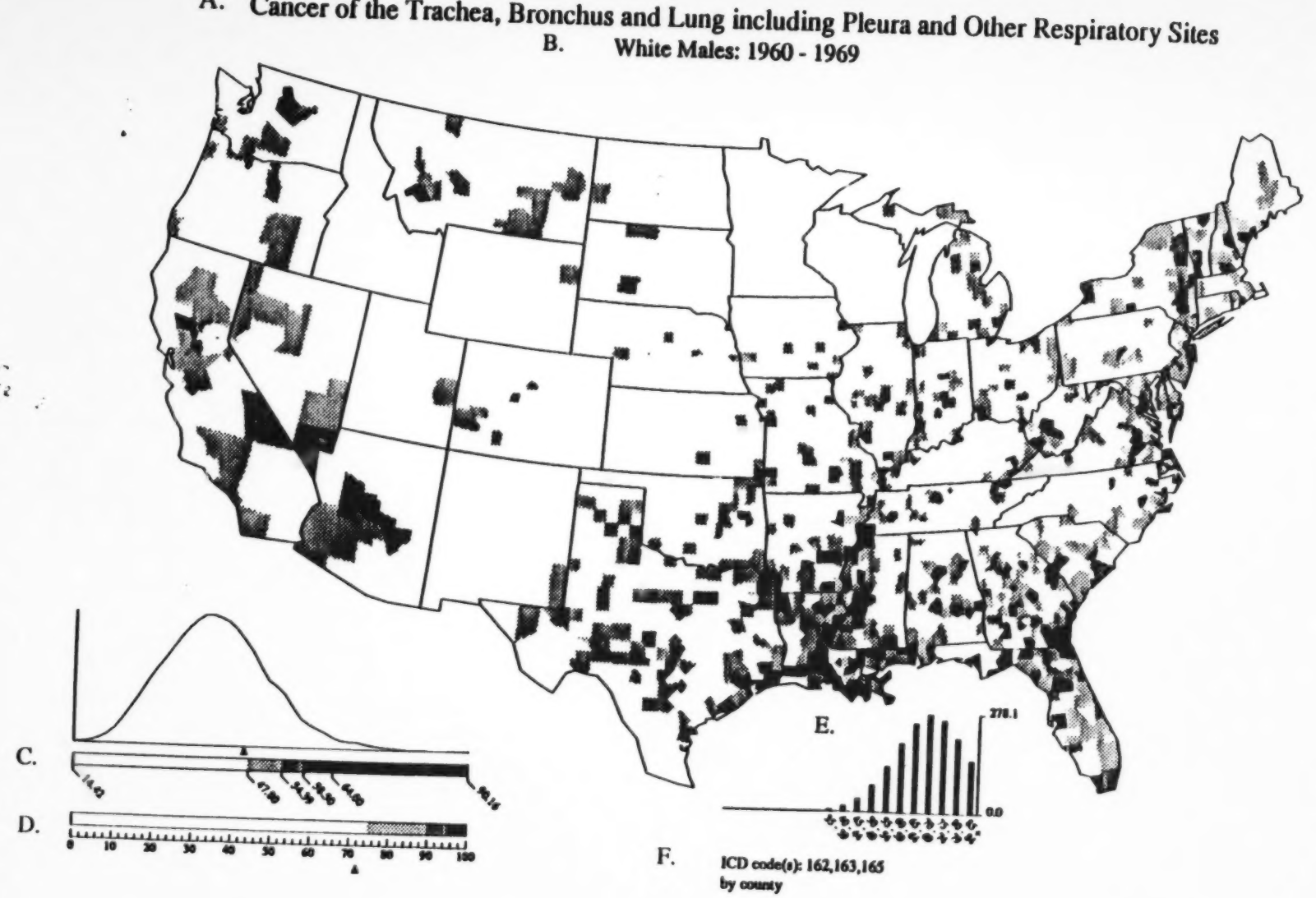
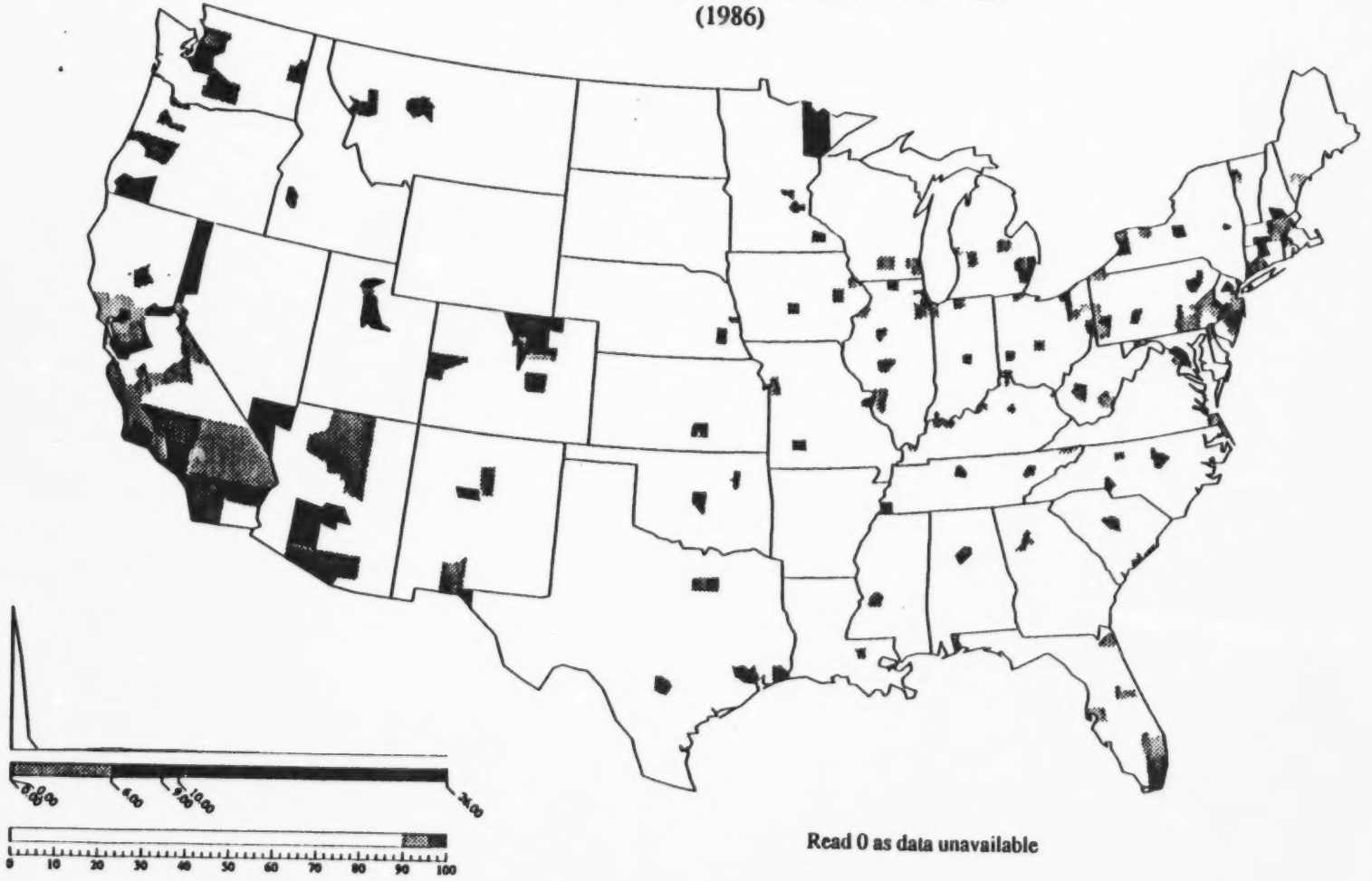

A. Cancer of the Trachea, Bronchus and Lung including Pleura and Other Respiratory Sites
B. White Males: 1960 - 1969
C.
D.
0 10 20 30 40 50 60 70 80 90 100
E.
278.1
0.0
F. ICD code(s): 162,163,165
by county

Figure 2.

Carbon Monoxide: Parts per Million
Readings from Second Maximum 8 Hour Period
(1986)



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